IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Inventors:	Joseph H. Steinmetz et al.
Serial No.	10/602,529
Filed:	June 23, 2003
For:	Integrated-circuit implementation of a storage-shelf router and a path controller card for combined use in high-availability mass-storage-device shelves that may be incorporated within disk arrays

Examiner: Kim Hgoc Huynh
Group Art Unit: 2182
Docket No. 35022.001C1
Date: June 15, 2006

SUPPLEMENTAL BRIEF ON APPEAL

Mail Stop Appeal Brief
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the re-opening of prosecution by the Examiner in the Office Communication mailed May 15, 2006, Applicants hereby request reinstatement of the Appeal as provided under 37 CFR 1.193(b)(2).

REAL PARTY IN INTEREST

The real party in interest is Sierra Logic a Delaware Corporation and having a principal place of business at 9083 Foothills Blvd., Suite 300, Roseville, California 95747, U.S.A.

RELATED APPEALS AND INTERFERENCES

Applicants' representative filed on November 15, 2005, the same date as the original Appeal Brief is was filed, an Appeal Brief in response to a final rejection of claims 1-16 in U.S. Patent Application No. 10/702,065 which, like the current application, is assigned to Sierra Logic and which is directed to subject matter related to that of the current application.

STATUS OF CLAIMS

Claims 1-43 are pending in the application. Claims 1-43 were restricted in the Office Action dated June 15, 2006. Applicants' appeal the restriction of claims 1-43, which are copied in the attached CLAIMS APPENDIX.

STATUS OF AMENDMENTS

No Amendment After Final is enclosed with this Supplemental Appeal Brief.

SUMMARY OF CLAIMED SUBJECT MATTER

Overview

The present invention is directed to a single-integrated-circuit implementation ("single-IC") of a storage-shelf router. Storage-shelf routers are thoroughly described in the current application beginning at the top of page 33. The concept of a storage-shelf router is succinctly summarized in Figures 9-11 of the current application. A storage-shelf router (906 in Figure 9; 1014 and 1018 in Figure 10; 1102 and 1104 in Figure 11) is contained within a storage shelf (1010 in Figure 10; 1100 in Figure 11) is connected through one or more high-bandwidth communications media, such as fiber channel ("FC") communications media (908 in Figure 9; 1012 and 1016 in Figure 10) to an external processing entity, such as a disk-array controller (902 in Figure 9; 1006 in Figure 10), the external processing entity in turn interconnected with remote server and host computers (1002 and 1004 in Figure 10). The storage-shelf router is additionally connected, through mass-storage-device links (918 in Figure 9, 1028 in Figure 10), such as serial communications media, to a number of mass-storage devices within the storage shelf. One or more storage-shelf routers within a storage

shelf serve to interface the number of mass-storage devices within the storage shelf to the external processing entity.

In one embodiment of the present invention described in the current application, a disk-array controller is implemented to directly interface with FC disk drives. In these described embodiments of the present invention, one or more storage-shelf routers in a storage shelf present a set of virtual FC disk drives, via a storage-shelf-router-implemented storage-shelf interface, to the disk-array controller, but the storage shelf actually contains cheaper ATA and/or SATA disk drives, rather than the more expensive FC disk drives with which the disk-array controller is designed to interface. The storage-shelf routers translate SCSI commands embedded within FC frames by the disk-array controller to ATA and SATA commands that the storage-shelf routers then forward to the ATA and/or SATA disk drives via serial links. The storage-shelf routers thus both translate SCSI commands to ATA commands and ATA command responses to SCSI command responses as well as bridge FC communications media to ATA and/or SATA communications links.

The described embodiments of the present invention concern storage-shelf routers within storage shelves accessed via FC communications media by a disk-array controller, the storage shelf containing ATA and/or SATA disk drives to which the disk-array controller cannot directly interface. However, the current application is more generally directed to storage-shelf routers and interface-tunneling mechanisms that allow any of a variety of different types of external processing entities to directly interface to physical mass-storage devices within a storage shelf and, in particular, to send a small number of mass-storage-device-type-specific testing, maintenance, and update commands to the mass-storage devices when the external processing entities do not support a general, direct interface to the mass-storage devices.

One embodiment of the present invention is a single-IC storage-shelf router, used in combination with path controller cards and optionally with other single-IC storage-shelf routers, to interconnect SATA disks within a storage shelf or disk array to a high-bandwidth communications medium, such as an FC arbitrated loop. An overview of one embodiment of the claimed single-IC storage-shelf router is shown in Figure 15, of the current application and described beginning on line 12 of page 40 of the current application with reference to Figure 15. The single-IC storage router includes the major functional components shown in Figure 15, including two FC ports 1502 and 1504, a dual-CPU processing complex 1512, routing and FCP-protocol logic 1506 and 1508, a global shared

memory switch 1510, and a large number of SATA ports 1512-1518. Thus, the single-IC storage-shelf router to which the current application is directed includes ports to two separate instances of a first type of communications medium by which a storage shelf is interconnected to external processing entities, such as disk-array controllers, a number of ports to mass-storage devices interconnected to the storage-shelf router through a number of instances of a second type of communications medium, in the described embodiment of the present invention, serial SATA links, and complex logic for translating and routing commands from the first type of communications medium to the second type of communications medium, and for translating and routing responses from the second type of communications medium to the first type of communications medium.

The FC ports of the storage-shelf router (1502 and 1504 in Figure 15) are generally interconnected with corresponding FC ports of a disk-array controller or other external processing entity. The SATA ports (1512-1518) of the storage-shelf router are generally connected to path-controller cards, two examples of which are shown in Figures 14A-B. The path-controller cards provide two separate ports to two separate instances of a storage-device communications media, to provide fault tolerance within a storage shelf, and include additional logic and features to reliably interconnect a single mass-storage device, such as an ATA or SATA disk drive, to both ports, and via both ports, to two corresponding ports of one or more storage-shelf routers. Additional details of the single-IC storage-shelf router to which the current application and claims are directed are provided in Figures 17A-23, and are described in detail in the current application beginning on line 19 of page 44.

As can be readily appreciated by those familiar with disk arrays and high-availability storage shelves, a single-integrated-circuit implementation of a storage-shelf router is not a trivial undertaking. The single-IC implementation of the storage-shelf router described in the current application features many layers of extremely complex logic, and highly parallel processing of streams of information input through the FC ports to generate corresponding ATA and SATA commands transmitted by the single-IC storage-shelf router to mass-storage devices within the storage shelf. Similarly, highly efficient and parallel processing of command responses and data returned by the mass-storage devices to the storage-shelf router is undertaken in order to return the command responses and data through the FC ports to external processing entities, such as disk-array controllers.

The present invention is directed to a single-integrated-circuit implementation ("single-IC") of a storage-shelf router. Storage-shelf routers are thoroughly described in the current application beginning at the top of page 33. The concept of a storage-shelf router is succinctly summarized in Figures 9-11 of the current application. A storage-shelf router (906 in Figure 9; 1014 and 1018 in Figure 10; 1102 and 1104 in Figure 11) is contained within a storage shelf (1010 in Figure 10; 1100 in Figure 11) is connected through one or more high-bandwidth communications media, such as fiber channel ("FC") communications media (908 in Figure 9; 1012 and 1016 in Figure 10) to an external processing entity, such as a disk-array controller (902 in Figure 9; 1006 in Figure 10), the external processing entity in turn interconnected with remote server and host computers (1002 and 1004 in Figure 10). The storage-shelf router is additionally connected, through mass-storage-device links (918 in Figure 9, 1028 in Figure 10), such as serial communications media, to a number of mass-storage devices within the storage shelf. One or more storage-shelf routers within a storage shelf serve to interface the number of mass-storage devices within the storage shelf to the external processing entity.

Independent Claim 1

Independent claim 1 claims a storage shelf (1010 in Figure 10; 1100 in Figure 11; 1500 in Figure 15) that includes a first storage-shelf-router integrated circuit and a last storage-shelf-router integrated circuit, both storage-shelf-router integrated circuits (906 in Figure 9; 1014 and 1018 in Figure 10; 1102 and 1104 in Figure 11; 1500 in Figure 15) claimed to include basic components shown in Figure 15. The storage shelf is additionally claimed to contain a number of path-controller cards, such as the path-controller cards (*see* discussion beginning on line 1 of page 39 of the Current Application) discussed above and shown in Figures 14A-B of the current application.

Dependent Claims 2 – 8

Dependent claims 2 and 3 are directed to the storage shelf of claim 1 and further including interconnection of the two storage-shelf routers to one another and to two external communications media, as shown for storage shelves 1 and 2 in Figure 25 of the current application. Dependent claims 4-6 are directed to methods by which single-IC storage-shelf routers within a storage shelf are assigned unique numbers. Dependent claims 7 and 8 specifically claim described embodiments of the storage shelf described in the current

application, including storage shelves using ATA and SATA mass-storage devices and interconnected with external processing entities through FC communications media.

Independent Claim 9

Independent claim 9 is directed to a single-IC storage-shelf router (906 in Figure 9; 1014 and 1018 in Figure 10; 1102 and 1104 in Figure 11; 1500 in Figure 15) as shown in Figure 15 of the current application and as discussed above.

Dependent Claims 10 – 29

Dependent claims 10-29 add specific details and features of the single-IC storage-shelf router claimed in claim 9. For example, claim 10 includes first-in-first-out buffers (1706 and 1707 in Figure 17A), claim 11 specifies parallel operation of the first-in-first-out buffers by other components of the storage-shelf router, claim 12 discusses how routing logic directs received commands to a shared memory component within the storage-shelf router, and claim 13 includes a global-shared-memory switch and virtual queues. Claims 14-27 are directed to various facets of operation of the routing logic (1506 in Figure 15) including the routing layer of the single-IC storage-shelf router of claim 9. Claims 28 and 29 specify details of described embodiments of the storage-shelf router in the current application, including the types of internal storage-shelf communications media and communications media interconnecting a storage shelf that includes storage-shelf routers to an external processing entity.

Independent Claim 30

Independent claim 30 is directed to the routing layer (1506 in Figure 15) of s single-IC-storage-shelf-router (906 in Figure 9; 1014 and 1018 in Figure 10; 1102 and 1104 in Figure 11; 1500 in Figure 15) embodiment of the present invention.

Dependent Claims 31 – 43

Claims 31-43 are directed to specific features and to operation of the routing layer (1506 in Figure 15) of the single-IC storage-shelf router to which the current application is directed.

ISSUES

1. Whether prosecution should be reopened for the Examiner's Restriction Requirement dated May 15, 2006.

ARGUMENT

Claims 1-43 are pending in the current application. In an Office Communication dated May 15, 2006, the Examiner required restriction of the claims, under 35 U.S.C. § 121, to one of claims 1-29 or claims 30-43. Applicants had previously filed an Appeal to the Board of Appeals and Interferences, on November 14, 2005, in response to the Examiner's Office Action dated June 13, 2005 ("Office Action"), in which the Examiner rejected claims 9-14 and 30 under 35 U.S.C. § 102(b) as being anticipated by Hoese et al., U.S. Patent No. 5,941,972 ("Hoese"), rejected claims 1-3 and 7-8 under 35 U.S.C. § 103(a) over Hoese in view of Walsh et al., U.S. Patent Publication No. 2002/0099972 A1 ("Walsh"), and rejected claims 7-8 and 28-30 under 35 U.S.C. § 103(a) as being obvious over Hoese in view of Walsh and further in view of Bissessur et al., U.S. Patent No. 6,820,140 B2 ("Bissessur"). On March 10, 2006, Applicants filed an amended Appeal to the Board of Appeals and Interferences in response to the Examiner's Office Communication dated February 10, 2006.

ISSUE 1

1. Whether prosecution should be reopened for the Examiner's Restriction Requirement dated May 15, 2006.

In an Office Communication dated May 15, 2006, the Examiner has reopened prosecution to require restriction of the claims of the current application to one of either Group I, comprising claims 1-29, or Group II, comprising claims 30-43. Applicants do not believe that the appeal process should be interrupted, and prosecution reopened, for this restriction requirement.

First, Applicants would traverse the restriction requirement. Claim 1 claims a storage shelf router that includes "routing logic for routing commands received through the first and second communications-medium ports to the one or more processors and for routing data received through the two or more communications-medium ports to the number of data-

storage-device-link-port components." Claim 30 claims a routing logic component within a storage shelf router. The Examiner states that claim 1, which includes the language "following a failure of a disk-drive link or data-storage-device-link port, receiving data and commands transmitted from one or more of the number of data-storage-device-link-port components of the other of the storage-shelf-router integrated circuits," is a combination with a subcombination described by the above-recited language, that (1) the combination does not require the particulars of the subcombination as claimed for patentability, and that (2) the combination has utility by itself. Claim 1 was finally rejected by the Examiner as unpatentable, so it is difficult to imagine how the Examiner can now claim that the combination claimed in claim 1 does not require the alleged subcombination for patentability. Moreover, claim 1 is directed to a storage shelf router that includes a first storage-shelf-router integrated circuit, a last storage-shelf-router integrated circuit, and a number of path controller cards. The language, quoted above, that the Examiner claims to represent a subcombination refers to the ability of a path-controller card to accept data and commands from either the first storage-shelf-router integrated circuit and the last storage-shelf-router integrated circuit. Lacking this ability, one of the two recited storage-shelf-router integrated circuits would be unable to communicate with the storage device to which the path-controller card interfaces. This would, in turn, make one of the two storage-shelf-router integrated circuits useless. The point of using two or more storage-shelf-router integrated circuits is so that, when certain failures occur that prevent one storage-shelf-router integrated circuit from accessing a storage device, the other or others of the storage-shelf-router integrated circuits within a storage shelf can take over control of the storage device. The Examiner's first argument for restriction makes little sense. The Examiner's argument that the storage-shelf-router integrated circuit of claims 9-29 is a separate subcombination from the routing logic component within a storage shelf router claimed in claims 30-43 makes even less sense. The routing logic component within a storage shelf router is a fundamental component of storage-shelf-router integrated circuit implementation. Without the routing logic component, a storage-shelf-router integrated circuit would be inoperable.

Second, even were the Examiner's restriction requirements based on sound arguments, according to MPEP § 803:

> If the search and examination of an entire application can be made without serious burden, the examiner must examine it on the merits, even though it includes claims to independent or distinct inventions.

As further stated the MPEP § 803:

> There are two criteria for a proper requirement for restriction between patentably distinct inventions:
> (A) The inventions must be independent; and
> (B) There must be a serious burden on the examiner if restriction is required.
> (references to other MPEP sections omitted)

It is hard to imagine that the Examiner's burden in concurrently searching for references related to a storage shelf that includes storage-shelf-router integrated circuits and related to a routing logic component within a storage shelf router would be any greater than separately searching for storage shelf that includes storage-shelf-router integrated circuits and for a routing logic component within a storage-shelf-router integrated circuit. The claimed storage shelf router includes, and is fundamentally based on, storage-shelf-router integrated circuits, and storage-shelf-router integrated circuits include a routing logic component. A search for any one of the two types of claims would almost certainly involve searching for the other of the two. In fact, it would seem to be a far greater burden to separately search for a storage shelf that includes storage-shelf-router integrated circuits and for a routing logic component within a storage shelf router.

Third, the Examiner has finally rejected claims from both Group I and Group II, identified by the Examiner, and those rejections are commonly addressed in the originally filed Appeal Brief. It is hard to imagine that any purpose can now be served by restricting the claims, and thereby necessitating two different Appeals directed to such closely related subject matter.

Finally, Applicants have spent significant time and money, and have incurred significant delay in obtaining patent rights, to appeal the final rejections of claims 1-3, 7-14, and 28-30. Applicants do not feel that their interests, or anyone else's interests, would be served by interrupting the appeal process at this point in time to address a restriction requirement which could easily have been made prior to the appeal, and which can also be easily made following a decision of the Board of Appeals and Interferences.

CONCLUSION

In summary, as discussed in detail above, Applicants believe that the appeal of the current application should proceed, and that prosecution should not be reopened at this time. Applicant respectfully submits that all statutory requirements are met and that the

present application is allowable over all the references of record. Therefore, Applicant respectfully requests that the present application be passed to issue.

Respectfully submitted,
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CLAIMS APPENDIX

1. A storage shelf that contains a number of data-storage devices interconnected to a communications medium, the storage shelf including:

a first storage-shelf-router integrated circuit and a last storage-shelf-router integrated circuit, each storage-shelf router integrated circuit including

a first communications-medium port,

a second communications-medium port,

one or more processors,

a number of disk-drive-link-port components that transmit data and commands to the number of data-storage devices through disk-drive links, and

routing logic for routing commands received through the first and second communications-medium ports to the one or more processors and for routing data received through the two or more communications-medium ports to the number of data-storage-device-link-port components; and

a number of path controller cards, each path controller card

receiving data and commands transmitted through disk-drive links from the number of data-storage-device-link-port components of one of the two storage-shelf-router integrated circuits, and, following a failure of a disk-drive link or data-storage-device-link port, receiving data and commands transmitted from one or more of the number of data-storage-device-link-port components of the other of the storage-shelf-router integrated circuits, and

transmitting the received data and commands to a data-storage device.

2. The storage shelf of claim 1 wherein the storage shelf is interconnected to a first communications medium and to a second communications medium, and wherein the number of storage-shelf-router integrated circuits are linked together in a first series, the first series comprising:

the first communications medium;

the first storage-shelf-router integrated circuit connected to the first communications medium through the first communications-medium port of the first storage-shelf-router and connected to the last storage-shelf-router integrated circuit through the

second communications-medium port of the first storage-shelf-router integrated circuit, the first communications-medium port of the last storage-shelf-router integrated circuit, and an internal communications medium; and

the last storage-shelf-router integrated circuit.

3. The storage shelf of claim 2 wherein the number of storage-shelf-router integrated circuits are linked together in a second series, the second series comprising:

the second communications medium;

the last storage-shelf-router integrated circuit connected to the second communications medium through the second communications-medium port of the last storage-shelf-router and connected to the first storage-shelf-router integrated circuit through the first communications-medium port of the last storage-shelf-router integrated circuit, the second communications-medium port of the last storage-shelf-router integrated circuit, and the internal communications medium; and

the first storage-shelf-router integrated circuit.

4. The storage shelf of claim 3 further including additional storage-shelf-router integrated circuits, each storage-shelf router integrated circuit linked together in the first series and the second series in between the first storage-shelf-router integrated circuit and the last storage-shelf-router integrated circuit, the storage-shelf-router integrated circuits each assigned a unique number, the first storage-shelf-router integrated circuit assigned a lowest unique number, the last storage-shelf-router integrated circuit assigned a highest unique number, the unique numbers assigned to the additional storage-shelf-router integrated circuits increasing along the first series and decreasing along the second series.

5. The storage shelf of claim 4 wherein each additional storage-shelf-router integrated circuit having an assigned unique number is linked to a storage-shelf-router integrated circuit with a lower unique number than the assigned unique number through the first communications-medium port of the additional storage-shelf-router, the second communications-medium port of the storage-shelf-router integrated circuit with a lower unique number than the assigned unique number, and an internal communications medium connecting the additional storage-shelf-router integrated circuit with the storage-shelf-router integrated circuit with a lower unique number than the assigned unique number.

6. The storage shelf of claim 4 wherein each additional storage-shelf-router integrated circuit having an assigned unique number is linked to a storage-shelf-router integrated circuit with a higher unique number than the assigned unique number through the second communications-medium port of the additional storage-shelf-router, the first communications-medium port of the storage-shelf-router integrated circuit with a higher unique number than the assigned unique number, and an internal communications medium connecting the additional storage-shelf-router integrated circuit with the storage-shelf-router integrated circuit with a higher unique number than the assigned unique number.

7. The storage shelf of claim 1

wherein the communications medium is a fibre channel arbitrated loop, and

wherein each of the number of data-storage devices is an Advanced Technology Attachment disk drive.

8. The storage shelf of claim 1

wherein the communications medium is a fibre channel arbitrated loop,

wherein each of the number of data-storage devices is a Serial Advanced Technology Attachment disk drive, and

wherein the number of data-storage-device-link-port components are Serial Advanced Technology Attachment ports.

9. A storage-shelf-router integrated circuit employed within a storage shelf that contains a number of data-storage devices interconnected to two communications media, the storage-shelf-router integrated circuit including:

a first communications-medium port;

a second communications-medium port;

one or more processors;

a number of data-storage-device-link-port components that transmit data and commands to the number of data-storage devices through disk-drive links; and

routing logic for routing commands received through the first and second communications-medium ports to the one or more processors and for routing data received

through the two or more communications-medium ports to the number of data-storage-device-link-port components.

10. The storage-shelf-router integrated circuit of claim 9 wherein each of the two communications-medium ports include a first-in-first-out buffer into which commands and data received by the communications-medium port are written, and from which command and data received by the communications-medium port are accessed by the routing logic.

11. The storage-shelf-router integrated circuit of claim 10 wherein the routing logic may access an initial portion of a command or data from the first-in-first-out buffer while the communications-medium port is writing a latter portion of the command or data into the first-in-first-out buffer.

12. The storage-shelf-router integrated circuit of claim 10 wherein the routing logic routes commands accessed from the first-in-first-out buffer within the two communications-medium ports to the one or more processors by directing the commands to a storage-shelf-router-integrated-circuit module that writes the commands to a shared memory, from which the commands can be accessed by the one or more processors.

13. The storage-shelf-router integrated circuit of claim 10 wherein the routing logic routes data accessed from the first-in-first-out buffer within the two communications-medium ports to the number of data-storage-device-link-port components by directing the data to a storage-shelf-router-integrated-circuit module that writes the data to a virtual queue within a global-shared-memory switch, from which the data can be accessed by the one of the one or more number of data-storage-device-link-port components.

14. The storage-shelf-router integrated circuit of claim 9 wherein the storage-shelf-router integrated circuit is assigned a unique number and is linked through the first communications-medium port and a first communications medium to a first entity and is linked through the second communications-medium port and a second communications medium to a second entity, the first entity one of

a remote device external to the storage shelf, and

a storage-shelf-router integrated circuit having a unique number less than the assigned unique number, and

the second entity one of

a remote device external to the storage shelf, and

a storage-shelf-router integrated circuit having a unique number greater than the assigned unique number.

15. The storage-shelf-router integrated circuit of claim 14 wherein the storage-shelf-router integrated circuit further includes a routing table that lists, for each data-storage device interconnected through the number of data-storage-device-link-port components to the storage-shelf-router integrated circuit, a first-communications-medium address associated with the data-storage device, a second-communications-medium address associated with the data-storage device, and additional information related to the data-storage-device addresses supported by the data-storage device.

16. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a command message received through the first communications-medium port, the routing logic

routes the command message to one of the one or more processors when a destination address of the command message matches a first-communications-medium address associated with a data-storage device in the routing table,

routes the command message to the second communications-medium port when the destination address of the command message does not match a first-communications-medium address associated with a data-storage device in the routing table, and the second entity is not a remote device external to the storage shelf,

routes the command message to the first communications-medium port when the destination address of the command message does not match a first-communications-medium address associated with a data-storage device in the routing table, and the second entity is a remote device external to the storage shelf, and

routes the command message to one of the one or more processors when the routing logic determines that the command message needs error handling.

17. The storage-shelf-router integrated circuit of claim 16 wherein the routing logic determines that the command message needs error handling when the routing logic accesses additional tables within the storage-shelf-router integrated circuit and determines that the entity which sent the command message is not authorized to direct a command to a data-storage device interconnected to the storage-shelf router.

18. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a data message received through the first communications-medium port, the routing logic

routes the data message to one of the number of data-storage-device-link-port components when a destination address of the command message matches a first-communications-medium address associated with a data-storage device in the routing table,

routes the data message to the second communications-medium port when the destination address of the command message does not match a first-communications-medium address associated with a data-storage device in the routing table, and the second entity is not a remote device external to the storage shelf,

routes the data message to the first communications-medium port when the destination address of the command message does not match a first-communications-medium address associated with a data-storage device in the routing table, and the second entity is a remote device external to the storage shelf, and

routes the data message to one of the one or more processors when the routing logic determines that the data message needs error handling.

19. The storage-shelf-router integrated circuit of claim 18 wherein the routing logic determines that the data message needs error handling when the routing logic accesses additional tables within the storage-shelf-router integrated circuit and determines that no context has been created within shared memory during processing of a previous command message for a data transfer operation, all or a portion of which involves the data message and when the routing logic accesses additional tables within the storage-shelf-router integrated circuit and determines that the entity which sent the command message is not authorized to direct data to a data-storage device interconnected to the storage-shelf router.

20. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a status message received through the first communications-medium port, the routing logic

routes the status message to the second communications-medium port when the second entity is not a remote device external to the storage shelf, and

routes the status message to the first communications-medium port when the second entity is a remote device external to the storage shelf.

21. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a storage-shelf-internal-management message received through the first communications-medium port, the routing logic

routes the storage-shelf-internal-management message to one of the one or more processors when a destination address of the storage-shelf-internal-management message matches the unique number assigned to the storage-shelf-router integrated circuit,

routes the storage-shelf-internal-management message to the second communications-medium port when the destination address of the storage-shelf-internal-management message is greater than the unique number assigned to the storage-shelf-router integrated circuit and the second entity is not a remote device external to the storage shelf, and

routes the storage-shelf-internal-management message to one of the one or more processors when the routing logic determines that the storage-shelf-internal-management message needs error handling.

22. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a command message received through the second communications-medium port, the routing logic

routes the command message to one of the one or more processors when a destination address of the command message matches a second-communications-medium address associated with a data-storage device in the routing table,

routes the command message to the first communications-medium port when the destination address of the command message does not match a second-communications-medium address associated with a data-storage device in the routing table, and the first entity is not a remote device external to the storage shelf,

routes the command message to the second communications-medium port when the destination address of the command message does not match a second-communications-medium address associated with a data-storage device in the routing table, and the first entity is a remote device external to the storage shelf, and

routes the command message to one of the one or more processors when the routing logic determines that the command message needs error handling.

23. The storage-shelf-router integrated circuit of claim 22 wherein the routing logic determines that the command message needs error handling when the routing logic accesses additional tables within the storage-shelf-router integrated circuit and determines that the entity which sent the command message is not authorized to direct a command to a data-storage device interconnected to the storage-shelf router.

24. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a data message received through the second communications-medium port, the routing logic

routes the data message to one of the number of data-storage-device-link-port components when a destination address of the command message matches a second-communications-medium address associated with a data-storage device in the routing table,

routes the data message to the first communications-medium port when the destination address of the command message does not match a second-communications-medium address associated with a data-storage device in the routing table, and the first entity is not a remote device external to the storage shelf,

routes the data message to the second communications-medium port when the destination address of the command message does not match a second-communications-medium address associated with a data-storage device in the routing table, and the first entity is a remote device external to the storage shelf, and

routes the data message to one of the one or more processors when the routing logic determines that the data message needs error handling.

25. The storage-shelf-router integrated circuit of claim 24 wherein the routing logic determines that the data message needs error handling when the routing logic accesses additional tables within the storage-shelf-router integrated circuit and determines that no

context has been created within shared memory during processing of a previous command message for a data transfer operation, all or a portion of which involves the data message and when the routing logic accesses additional tables within the storage-shelf-router integrated circuit and determines that the entity which sent the command message is not authorized to direct data to a data-storage device interconnected to the storage-shelf router

26. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a status message received through the second communications-medium port, the routing logic

routes the status message to the first communications-medium port when the first entity is not a remote device external to the storage shelf, and

routes the status message to the second communications-medium port when the first entity is a remote device external to the storage shelf.

27. The storage-shelf-router integrated circuit of claim 15 wherein, when the routing logic accesses a storage-shelf-internal-management message received through the second communications-medium port, the routing logic

routes the storage-shelf-internal-management message to one of the one or more processors when a destination address of the storage-shelf-internal-management message matches the unique number assigned to the storage-shelf-router integrated circuit,

routes the storage-shelf-internal-management message to the first communications-medium port when the destination address of the storage-shelf-internal-management message is less than the unique number assigned to the storage-shelf-router integrated circuit and the first entity is not a remote device external to the storage shelf, and

routes the storage-shelf-internal-management message to one of the one or more processors when the routing logic determines that the storage-shelf-internal-management message needs error handling.

28. A storage-shelf-router integrated circuit of claim 9

wherein each of the number of data-storage devices is an Advanced Technology Attachment disk drive,

wherein each of the communications media is a fibre channel arbitrated loop.

29. A storage-shelf-router integrated circuit of claim 9

wherein each of the communications media is a fibre channel arbitrated loop,

wherein each of the number of data-storage devices is a Serial Advanced Technology Attachment disk drive, and

wherein the number of data-storage-device-link-port components are Serial Advanced Technology Attachment ports.

30. A routing logic component within a local storage-shelf router, included within a storage shelf, that includes a first port to a first communications medium, a second port to a second communications medium, a command and error processing component, and a data-storage-link-port layer, the routing logic component comprising:

destination logic that determines whether a message received from one of the first port and the second port is directed to the local storage-shelf-router, to a remote storage shelf router intercommunicating with the local storage router, or to a remote entity external to the storage shelf; and

routing logic that routes a message received from one of the first port and the second port to one of the first port and second port in order to forward the message to a remote storage-shelf router when the destination logic determines that the message is directed to the remote storage-shelf router, that routes a message received from one of the first port and the second port to one of the first port and second port in order to forward the message to a remote entity external to the storage shelf when the destination logic determines that the message is directed to the remote entity external to the storage shelf, and that routes the message received from one of the first port and the second port to one of the command and error processing component or to the data-storage-link-port layer when the destination logic determines that the message is directed to the local storage-shelf router.

31. The routing logic component of claim 30

wherein the routing logic component accesses a routing table within the storage-shelf router that lists, for each of a number of data-storage devices interconnected through the data-storage-link-port layer to the storage-shelf router, a first-communications-medium address associated with the data-storage device, a second-communications-medium address associated with the data-storage device, and additional information related to data-storage-device addresses supported by the data-storage device,

wherein the storage-shelf router is assigned a unique number and is linked through the first port to a first entity and is linked through the second port to a second entity,

wherein the first entity is one of

a remote device external to the storage shelf, and

a storage-shelf router having a unique number less than the assigned unique number, and

wherein the second entity is one of

a remote device external to the storage shelf, and

a storage-shelf router having a unique number greater than the assigned unique number.

32. The routing logic component of claim 31 wherein, when the routing logic component accesses a command message received through the first port, the routing logic component

routes the command message to the command and error processing component when a destination address within the command message matches a first-communications-medium address in the routing table,

routes the command message to the second port when the destination address within the command message does not match a first-communications-medium address in the routing table, and the second entity is not a remote device external to the storage shelf,

routes the command message to the first port when the destination address of the command message does not match a first-communications-medium address in the routing table, and the second entity is a remote device external to the storage shelf, and

routes the command message to the command and error processing component when the routing logic component determines that the command message needs error handling.

33. The routing logic component of claim 32 wherein the routing logic component determines that the command message needs error handling when the routing logic component accesses additional tables within the storage-shelf-router integrated circuit and determines that the entity which sent the command message is not authorized to direct a command to a data-storage device interconnected with the storage-shelf router.

34. The routing logic component of claim 31 wherein, when the routing logic component accesses a data message received through the first port, the routing logic component

routes the data message to the data-storage-link-port layer when a destination address within the data message matches a first-communications-medium address in the routing table,

routes the data message to the second port when the destination address within the data message does not match a first-communications-medium address in the routing table, and the second entity is not a remote device external to the storage shelf,

routes the data message to the first port when the destination address within the data message does not match a first-communications-medium address in the routing table, and the second entity is a remote device external to the storage shelf, and

routes the data message to the command and error processing component when the routing logic component determines that the data message needs error handling.

35. The routing logic component of claim 34 wherein the routing logic component determines that the data message needs error handling when the routing logic component accesses additional tables within the storage-shelf router and determines that no context has been created within shared memory during processing of a previous command message for a data transfer operation, all or a portion of which involves the data message and when the routing logic component accesses additional tables within the storage-shelf router and determines that the entity which sent the command message is not authorized to direct data to a data-storage device interconnected to the storage-shelf router.

36. The routing logic component of claim 31 wherein, when the routing logic component accesses a status message received through the first port, the routing logic component

routes the status message to the second port when the second entity is not a remote device external to the storage shelf, and

routes the status message to the first port when the second entity is a remote device external to the storage shelf.

37. The routing logic component of claim 31 wherein, when the routing logic component accesses a storage-shelf-internal-management message received through the first port, the routing logic component

routes the storage-shelf-internal-management message to the command and error processing component when a destination address within the storage-shelf-internal-management message matches the unique number assigned to the storage-shelf router,

routes the storage-shelf-internal-management message to the second port when the destination address within the storage-shelf-internal-management message is greater than the unique number assigned to the storage-shelf router and the second entity is not a remote device external to the storage shelf, and

routes the storage-shelf-internal-management message to the command and error processing component when the routing logic determines that the storage-shelf-internal-management message needs error handling.

38. The routing logic component of claim 31 wherein, when the routing logic component accesses a command message received through the second port, the routing logic component

routes the command message to the command and error processing component when a destination address within the command message matches a second-communications-medium address in the routing table,

routes the command message to the first port when the destination address within the command message does not match a second-communications-medium address in the routing table, and the first entity is not a remote device external to the storage shelf,

routes the command message to the second port when the destination address of the command message does not match a second-communications-medium address in the routing table, and the first entity is a remote device external to the storage shelf, and

routes the command message to the command and error processing component when the routing logic component determines that the command message needs error handling.

39. The routing logic component of claim 38 wherein the routing logic component determines that the command message needs error handling when the routing logic component accesses additional tables within the storage-shelf-router integrated circuit and determines that the entity which sent the command message is not authorized to direct a command to a data-storage device interconnected with the storage-shelf router.

40. The routing logic component of claim 31 wherein, when the routing logic component accesses a data message received through the second port, the routing logic component

routes the data message to the data-storage-link-port layer when a destination address within the data message matches a second-communications-medium address in the routing table,

routes the data message to the first port when the destination address within the data message does not match a second-communications-medium address in the routing table, and the first entity is not a remote device external to the storage shelf,

routes the data message to the second port when the destination address within the data message does not match a second-communications-medium address in the routing table, and the first entity is a remote device external to the storage shelf, and

routes the data message to the command and error processing component when the routing logic component determines that the data message needs error handling.

41. The routing logic component of claim 34 wherein the routing logic component determines that the data message needs error handling when the routing logic component accesses additional tables within the storage-shelf router and determines that no context has been created within shared memory during processing of a previous command message for a data transfer operation, all or a portion of which involves the data message and when the routing logic component accesses additional tables within the storage-shelf router and determines that the entity which sent the command message is not authorized to direct data to a data-storage device interconnected to the storage-shelf router.

42. The routing logic component of claim 31 wherein, when the routing logic component accesses a status message received through the second port, the routing logic component

routes the status message to the first port when the first entity is not a remote device external to the storage shelf, and

routes the status message to the second port when the first entity is a remote device external to the storage shelf.

43. The routing logic component of claim 31 wherein, when the routing logic component accesses a storage-shelf-internal-management message received through the second port, the routing logic component

routes the storage-shelf-internal-management message to the command and error processing component when a destination address within the storage-shelf-internal-management message matches the unique number assigned to the storage-shelf router,

routes the storage-shelf-internal-management message to the first port when the destination address within the storage-shelf-internal-management message is greater than the

unique number assigned to the storage-shelf router and the first entity is not a remote device external to the storage shelf, and

routes the storage-shelf-internal-management message to the command and error processing component when the routing logic determines that the storage-shelf-internal-management message needs error handling.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.

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PATENT

I hereby certify that on the date specified below, this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to Mail Stop Appeal Brief, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Date

Joanne Bourguignon

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Joseph H. Steinmetz et al.
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Docket No. 35022.001C1
Date: June 15, 2006

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR REINSTATEMENT OF THE APPEAL UNDER 37 CFR § 1.193(2)(ii)

Sir:

In response to the amended Appeal Brief filed March 10, 2006, and the subsequent Office Action dated May 15, 2006, Applicants respectfully request the reinstatement of the appeal. Accompanying this Request is a Supplemental Appeal Brief in triplicate.

Applicants believe that no fee is required. However, at any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account No. 50-2976. A duplicate copy of this transmittal letter is enclosed.

Respectfully submitted,
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Enclosures:
Postcard
Transmittal in duplicate
Supplemental Appeal Brief